

CLAIMS

1. A thin-film magnetic head substrate comprising:

a ceramic base with a principal surface; and

an undercoat film, which is made of an aluminum oxide and which covers the principal surface of the ceramic base, an electrical/magnetic transducer being provided on the undercoat film,

wherein the substrate further includes an intermediate layer between the principal surface of the ceramic base and the undercoat film, and

wherein the intermediate layer is made of a material other than the aluminum oxide and has been patterned so as to make a portion of the principal surface of the ceramic base contact with the undercoat film.

2. The thin-film magnetic head substrate of claim 1, wherein the intermediate layer has an opening where the electrical/magnetic transducer is not located.

3. The thin-film magnetic head substrate of claim 2,

wherein the electrical/magnetic transducer provided on the undercoat film includes: a lower magnetic shield film; a magneto-resistive element arranged on the lower magnetic shield film; and an upper shield film, which has been deposited on the lower magnetic shield film so as to cover the magneto-resistive element, and

wherein the intermediate layer has been patterned so as to cover the entire projection of the magneto-resistive element on the principal surface of the ceramic base.

4. The thin-film magnetic head substrate of claim 3, wherein the intermediate layer has been patterned so as to cover the entire projection of the lower magnetic shield film on the principal surface of the ceramic base.

5. The thin-film magnetic head substrate of claim 1, wherein a portion of the intermediate layer makes an alignment mark for use in positional alignment.

6. The thin-film magnetic head substrate of claim 1,

wherein a portion of the intermediate layer makes a pattern representing identification information.

7. The thin-film magnetic head substrate of claim 6, wherein the identification information includes information about the identity of the ceramic base.

8. The thin-film magnetic head substrate of claim 6 or 7, wherein the pattern representing the identification information has been recorded on a plurality of areas of the principal surface of the ceramic base, mutually different pieces of the information being distributed to the respective areas.

9. The thin-film magnetic head substrate of claim 8, wherein the areas are arranged so as to form multiple different thin-film magnetic heads when the substrate is divided.

10. The thin-film magnetic head substrate of claim 1,

wherein the intermediate layer has a thickness of 1 nm to 1 μm .

11. The thin-film magnetic head substrate of claim 1, wherein the intermediate layer is made of a metal film or an Si film.

12. The thin-film magnetic head substrate of claim 1, wherein the intermediate layer is made of a material selected from the group consisting of Cu, alloys including Cu, Cr, alloys including Cr, and Si.

13. The thin-film magnetic head substrate of claim 1, wherein the undercoat film has a thickness of 10 nm to 1 μm .

14. The thin-film magnetic head substrate of claim 1, wherein the ceramic base is made of an alumina-based ceramic material including 24 mol% to 75 mol% of $\alpha\text{-Al}_2\text{O}_3$ and at most 2 mol% of an additive.

15. The thin-film magnetic head substrate of claim 14, wherein the ceramic base further includes a carbide or nitride carbonate of a metal.

16. A thin-film magnetic head slider comprising:
the thin-film magnetic head substrate of claim 1; and
an electrical/magnetic transducer, which is provided on the undercoat film of the thin-film magnetic head substrate.

17. A hard disk drive comprising the thin-film magnetic head slider of claim 16.

18. A method of manufacturing a thin-film magnetic head substrate that includes a ceramic base with a principal surface and an undercoat film covering the principal surface of the ceramic base, an electrical/magnetic transducer being provided on the undercoat film, the method comprising the steps of

forming a patterned intermediate layer, made of a non-aluminum-oxide material, on the ceramic base, and

forming an undercoat film, made of an aluminum oxide, on the ceramic base such that the undercoat film covers the patterned intermediate layer.

19. The method of claim 18, wherein the step of forming the patterned intermediate layer includes the steps of:

depositing a film of the non-aluminum-oxide material on the ceramic base;

defining a patterned resist mask on the film;

etching away portions of the film that are not covered with the resist mask, thereby forming the patterned intermediate layer; and

removing the resist mask.

20. The method of claim 18, wherein the step of forming the patterned intermediate layer includes the steps of:

defining a patterned resist mask on the ceramic base;

depositing a film of the non-aluminum-oxide material on the resist mask; and

making the patterned intermediate layer out of portions

of the film by a liftoff process that removes the resist mask.

21. The method of claim 18, wherein the step of forming the patterned intermediate layer on the ceramic base includes patterning the intermediate layer such that the intermediate layer has an opening where the electrical/magnetic transducer is not located.

22. A method of making a thin-film magnetic head slider, the method comprising the steps of:

preparing the thin-film magnetic head substrate of claim 1; and

fabricating the electrical/magnetic transducer on the undercoat film.